

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



OPC unified architecture **Part 9: Alarms and Conditions** **STANDARD PREVIEW**  
**(standards.iteh.ai)**

Architecture unifiée OPC – **Partie 9: Alarmes et Conditions** **IEC 62541-9:2020**  
<https://standards.iteh.ai/catalog/standards/sist/89737e60-7c58-4dda-a7eb-f75d92c97068/iec-62541-9-2020>





## THIS PUBLICATION IS COPYRIGHT PROTECTED

Copyright © 2020 IEC, Geneva, Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either IEC or IEC's member National Committee in the country of the requester. If you have any questions about IEC copyright or have an enquiry about obtaining additional rights to this publication, please contact the address below or your local IEC member National Committee for further information.

Droits de reproduction réservés. Sauf indication contraire, aucune partie de cette publication ne peut être reproduite ni utilisée sous quelque forme que ce soit et par aucun procédé, électronique ou mécanique, y compris la photocopie et les microfilms, sans l'accord écrit de l'IEC ou du Comité national de l'IEC du pays du demandeur. Si vous avez des questions sur le copyright de l'IEC ou si vous désirez obtenir des droits supplémentaires sur cette publication, utilisez les coordonnées ci-après ou contactez le Comité national de l'IEC de votre pays de résidence.

IEC Central Office  
3, rue de Varembé  
CH-1211 Geneva 20  
Switzerland

Tel.: +41 22 919 02 11  
[info@iec.ch](mailto:info@iec.ch)  
[www.iec.ch](http://www.iec.ch)

### About the IEC

The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

### About IEC publications

The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

#### IEC publications search - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee,...). It also gives information on projects, replaced and withdrawn publications.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email. <https://standards.iteh.ai/catalog/standards/6578937/e60-7c58-4dd4-a-0e24412209>

#### IEC Customer Service Centre - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: [sales@iec.ch](mailto:sales@iec.ch).

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 16 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

#### IEC Glossary - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 electrotechnical terminology entries in English and French extracted from the Terms and Definitions clause of IEC publications issued since 2002. Some entries have been collected from earlier publications of IEC TC 37, 77, 86 and CISPR.

### A propos de l'IEC

La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

### A propos des publications IEC

Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

#### Recherche de publications IEC - [webstore.iec.ch/advsearchform](http://webstore.iec.ch/advsearchform)

La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études,...). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

#### IEC Just Published - [webstore.iec.ch/justpublished](http://webstore.iec.ch/justpublished)

Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

#### Service Clients - [webstore.iec.ch/csc](http://webstore.iec.ch/csc)

Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: [sales@iec.ch](mailto:sales@iec.ch).

#### Electropedia - [www.electropedia.org](http://www.electropedia.org)

Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

#### Glossaire IEC - [std.iec.ch/glossary](http://std.iec.ch/glossary)

67 000 entrées terminologiques électrotechniques, en anglais et en français, extraites des articles Termes et Définitions des publications IEC parues depuis 2002. Plus certaines entrées antérieures extraites des publications des CE 37, 77, 86 et CISPR de l'IEC.



IEC 62541-9

Edition 3.0 2020-06

# INTERNATIONAL STANDARD

# NORME INTERNATIONALE



OPC unified architecture **iTech STANDARD PREVIEW**  
**Part 9: Alarms and Conditions** ([standards.itech.ai](http://standards.itech.ai))

Architecture unifiée OPC –

[IEC 62541-9:2020](#)

Partie 9: Alarms et Conditions

<https://www.iec.ch/catalog/standards/sist/89737e60-7c58-4dda-a7eb-f75d92c97068/iec-62541-9-2020>

INTERNATIONAL  
ELECTROTECHNICAL  
COMMISSION

COMMISSION  
ELECTROTECHNIQUE  
INTERNATIONALE

ICS 25.040.40; 35.100.05

ISBN 978-2-8322-8465-0

**Warning! Make sure that you obtained this publication from an authorized distributor.**

**Attention! Veuillez vous assurer que vous avez obtenu cette publication via un distributeur agréé.**

## CONTENTS

FOREWORD .....	10
1 Scope .....	12
2 Normative references .....	12
3 Terms, definitions, abbreviated terms and data types used .....	12
3.1 Terms and definitions .....	12
3.2 Abbreviated terms .....	15
3.3 Data types used .....	15
4 Concepts .....	15
4.1 General .....	15
4.2 Conditions .....	15
4.3 Acknowledgeable Conditions .....	17
4.4 Previous states of Conditions .....	18
4.5 Condition state synchronization .....	19
4.6 Severity, quality, and comment .....	19
4.7 Dialogs .....	20
4.8 Alarms .....	20
4.9 Multiple active states .....	22
4.10 Condition instances in the Address Space .....	23
4.11 Alarm and Condition auditing .....	24
5 Model .....	24
5.1 General .....	24
5.2 Two-state state machines .....	25
<a href="http://standards.iteh.ai/catalog/standards/ist/89737e60-7e58-4ddc-a7cb-f75d92c97068/iec-62541-9-2020">http://standards.iteh.ai/catalog/standards/ist/89737e60-7e58-4ddc-a7cb-f75d92c97068/iec-62541-9-2020</a> .....	25
5.3 ConditionVariable .....	27
5.4 ReferenceTypes .....	27
5.4.1 General .....	27
5.4.2 HasTrueSubState ReferenceType .....	27
5.4.3 HasFalseSubState ReferenceType .....	28
5.4.4 HasAlarmSuppressionGroup ReferenceType .....	28
5.4.5 AlarmGroupMember ReferenceType .....	29
5.5 Condition Model .....	29
5.5.1 General .....	29
5.5.2 ConditionType .....	30
5.5.3 Condition and branch instances .....	34
5.5.4 Disable Method .....	34
5.5.5 Enable Method .....	35
5.5.6 AddComment Method .....	35
5.5.7 ConditionRefresh Method .....	36
5.5.8 ConditionRefresh2 Method .....	38
5.6 Dialog Model .....	40
5.6.1 General .....	40
5.6.2 DialogConditionType .....	40
5.6.3 Respond Method .....	42
5.7 Acknowledgeable Condition Model .....	42
5.7.1 General .....	42
5.7.2 AcknowledgeableConditionType .....	43
5.7.3 Acknowledge Method .....	44

5.7.4	Confirm Method .....	45
5.8	Alarm model.....	46
5.8.1	General .....	46
5.8.2	AlarmConditionType .....	47
5.8.3	AlarmGroupType .....	52
5.8.4	Reset Method .....	52
5.8.5	Silence Method.....	53
5.8.6	Suppress Method.....	54
5.8.7	Unsuppress Method.....	55
5.8.8	RemoveFromService Method .....	56
5.8.9	PlaceInService Method .....	56
5.8.10	ShelvedStateMachineType .....	57
5.8.11	LimitAlarmType.....	62
5.8.12	Exclusive limit types .....	64
5.8.13	NonExclusiveLimitAlarmType.....	67
5.8.14	Level Alarm .....	68
5.8.15	Deviation Alarm .....	69
5.8.16	Rate of change Alarms .....	70
5.8.17	Discrete Alarms .....	71
5.8.18	DiscrepancyAlarmType .....	75
5.9	ConditionClasses.....	75
5.9.1	<i>iTech STANDARD PREVIEW</i> <i>(standards.iteh.ai)</i>	75
5.9.2	BaseConditionClassType .....	76
5.9.3	ProcessConditionClassType .....	76
5.9.4	MaintenanceConditionClassType .....	77
5.9.5	SystemConditionClassType .....	77
5.9.6	SafetyConditionClassType .....	77
5.9.7	HighlyManagedAlarmConditionClassType .....	78
5.9.8	TrainingConditionClassType .....	78
5.9.9	StatisticalConditionClassType .....	78
5.9.10	TestingConditionSubClassType .....	79
5.10	Audit Events .....	79
5.10.1	Overview .....	79
5.10.2	AuditConditionEventType.....	80
5.10.3	AuditConditionEnableEventType.....	80
5.10.4	AuditConditionCommentEventType .....	80
5.10.5	AuditConditionRespondEventType .....	81
5.10.6	AuditConditionAcknowledgeEventType .....	81
5.10.7	AuditConditionConfirmEventType .....	82
5.10.8	AuditConditionShelvingEventType .....	82
5.10.9	AuditConditionSuppressionEventType .....	82
5.10.10	AuditConditionSilenceEventType .....	83
5.10.11	AuditConditionResetEventType .....	83
5.10.12	AuditConditionOutOfServiceEventType .....	83
5.11	Condition Refresh related Events .....	84
5.11.1	Overview .....	84
5.11.2	RefreshStartEventType .....	84
5.11.3	RefreshEndEventType .....	84
5.11.4	RefreshRequiredEventType .....	85

5.12	HasCondition Reference type.....	85
5.13	Alarm and Condition status codes .....	86
5.14	Expected A&C server behaviours .....	86
5.14.1	General .....	86
5.14.2	Communication problems .....	86
5.14.3	Redundant A&C servers .....	87
6	AddressSpace organisation .....	87
6.1	General.....	87
6.2	EventNotifier and source hierarchy .....	87
6.3	Adding Conditions to the hierarchy.....	88
6.4	Conditions in InstanceDeclarations .....	89
6.5	Conditions in a VariableType .....	90
7	System State and alarms .....	90
7.1	Overview.....	90
7.2	HasEffectDisable .....	90
7.3	HasEffectEnable .....	91
7.4	HasEffectSuppress .....	91
7.5	HasEffectUnsuppressed.....	92
8	Alarm metrics .....	93
8.1	Overview.....	93
8.2	AlarmMetricsType .....	93
8.3	AlarmRateVariableType .....	94
8.4	Reset Method .....	94
Annex A (informative)	Recommended localized names .....	96
A.1	Recommended state names for TwoState variables <a href="https://standards.iteh.ai/catdoc/twoStateList/89737160-7c58-4dda-a7eb-175d92c97068/iec-62541-9-2020">https://standards.iteh.ai/catdoc/twoStateList/89737160-7c58-4dda-a7eb-175d92c97068/iec-62541-9-2020</a> .....	96
A.1.1	LocaleId "en" .....	96
A.1.2	LocaleId "de" .....	96
A.1.3	LocaleId "fr" .....	97
A.2	Recommended dialog response options .....	98
Annex B (informative)	Examples .....	99
B.1	Examples for Event sequences from Condition instances .....	99
B.1.1	Overview .....	99
B.1.2	Server maintains current state only.....	99
B.1.3	Server maintains previous states .....	100
B.2	AddressSpace examples .....	101
Annex C (informative)	Mapping to EEMUA .....	104
Annex D (informative)	Mapping from OPC A&E to OPC UA A&C .....	105
D.1	Overview.....	105
D.2	Alarms and Events COM UA wrapper .....	105
D.2.1	Event Areas .....	105
D.2.2	Event sources.....	106
D.2.3	Event categories.....	106
D.2.4	Event attributes .....	107
D.2.5	Event subscriptions .....	107
D.2.6	Condition instances .....	109
D.2.7	Condition Refresh.....	110
D.3	Alarms and Events COM UA proxy .....	110
D.3.1	General .....	110

D.3.2	Server status mapping .....	110
D.3.3	Event Type mapping .....	110
D.3.4	Event category mapping .....	111
D.3.5	Event Category attribute mapping .....	112
D.3.6	Event Condition mapping .....	115
D.3.7	Browse mapping .....	115
D.3.8	Qualified names .....	116
D.3.9	Subscription filters .....	117
Annex E (informative)	IEC 62682 Mapping .....	119
E.1	Overview .....	119
E.2	Terms .....	119
E.3	Alarm records and State indications .....	125
Annex F (informative)	System State .....	126
F.1	Overview .....	126
F.2	SystemStateStateMachineType .....	127
Bibliography	.....	131
Figure 1 – Base Condition state model .....	16	
Figure 2 – AcknowledgeableConditions state model .....	17	
Figure 3 – Acknowledge state model .....	18	
Figure 4 – Confirmed Acknowledge state model .....	18	
Figure 5 – Alarm state machine model .....	21	
Figure 6 – Typical Alarm Timeline example .....	22	
Figure 7 – Multiple active states example .....	23	
Figure 8 – ConditionType hierarchy .....	25	
Figure 9 – Condition model .....	30	
Figure 10 – DialogConditionType overview .....	40	
Figure 11 – AcknowledgeableConditionType overview .....	43	
Figure 12 – AlarmConditionType Hierarchy Model .....	47	
Figure 13 – Alarm Model .....	48	
Figure 14 – Shelve state transitions .....	58	
Figure 15 – ShelvedStateMachineType model .....	58	
Figure 16 – LimitAlarmType .....	63	
Figure 17 – ExclusiveLimitStateMachineType .....	64	
Figure 18 – ExclusiveLimitAlarmType .....	66	
Figure 19 – NonExclusiveLimitAlarmType .....	67	
Figure 20 – DiscreteAlarmType Hierarchy .....	72	
Figure 21 – ConditionClass type hierarchy .....	76	
Figure 22 – AuditEvent hierarchy .....	79	
Figure 23 – Refresh Related Event Hierarchy .....	84	
Figure 24 – Typical HasNotifier Hierarchy .....	88	
Figure 25 – Use of HasCondition in a HasNotifier hierarchy .....	89	
Figure 26 – Use of HasCondition in an InstanceDeclaration .....	89	
Figure 27 – Use of HasCondition in a VariableType .....	90	
Figure B.1 – Single state example .....	99	

Figure B.2 – Previous state example.....	100
Figure B.3 – HasCondition used with Condition instances .....	102
Figure B.4 – HasCondition reference to a Condition type .....	103
Figure B.5 – HasCondition used with an instance declaration .....	103
Figure D.1 – The type model of a wrapped COM A&E server .....	107
Figure D.2 – Mapping UA Event Types to COM A&E Event Types.....	111
Figure D.3 – Example mapping of UA Event Types to COM A&E categories .....	112
Figure D.4 – Example mapping of UA Event Types to A&E categories with attributes.....	115
Figure F.1 – SystemState transitions .....	127
Figure F.2 – SystemStateStateMachineType Model .....	128
 Table 1 – Parameter types defined in IEC 62541-3 .....	15
Table 2 – Parameter types defined in IEC 62541-4 .....	15
Table 3 – TwoStateVariableType definition .....	26
Table 4 – ConditionVariableType definition .....	27
Table 5 – HasTrueSubState ReferenceType .....	28
Table 6 – HasFalseSubState ReferenceType .....	28
Table 7 – HasAlarmSuppressionGroup ReferenceType .....	29
Table 8 – AlarmGroupMember ReferenceType.....	29
Table 9 – ConditionType definition .....	31
Table 10 – SimpleAttributeOperand .....	34
Table 11 – Disable result codes .....	34
Table 12 – Disable Method AddressSpace definition .....	35
Table 13 – Enable result codes .....	35
Table 14 – Enable Method AddressSpace definition.....	35
Table 15 – AddComment arguments .....	36
Table 16 – AddComment result codes.....	36
Table 17 – AddComment Method AddressSpace definition .....	36
Table 18 – ConditionRefresh parameters .....	37
Table 19 – ConditionRefresh result codes .....	37
Table 20 – ConditionRefresh Method AddressSpace definition.....	38
Table 21 – ConditionRefresh2 parameters .....	38
Table 22 – ConditionRefresh2 result codes .....	39
Table 23 – ConditionRefresh2 Method AddressSpace definition.....	40
Table 24 – DialogConditionType definition .....	41
Table 25 – Respond parameters .....	42
Table 26 – Respond Result Codes .....	42
Table 27 – Respond Method AddressSpace definition.....	42
Table 28 – AcknowledgeableConditionType definition .....	43
Table 29 – Acknowledge parameters .....	44
Table 30 – Acknowledge result codes .....	44
Table 31 – Acknowledge Method AddressSpace definition .....	45
Table 32 – Confirm Method parameters .....	45

Table 33 – Confirm result codes .....	45
Table 34 – Confirm Method AddressSpace definition .....	46
Table 35 – AlarmConditionType definition .....	49
Table 36 – AlarmGroupType definition .....	52
Table 37 – Silence result codes .....	53
Table 38 – Reset Method AddressSpace definition .....	53
Table 39 – Silence result codes .....	53
Table 40 – Silence Method AddressSpace definition .....	54
Table 41 – Suppress result codes .....	54
Table 42 – Suppress Method AddressSpace definition .....	55
Table 43 – Unsuppress result codes .....	55
Table 44 – Unsuppress Method AddressSpace definition .....	55
Table 45 – RemoveFromService result codes .....	56
Table 46 – RemoveFromService Method AddressSpace definition .....	56
Table 47 – PlaceInService result codes .....	57
Table 48 – PlaceInService Method AddressSpace definition .....	57
Table 49 – ShelvedStateMachineType definition .....	59
Table 50 – ShelvedStateMachineType transitions .....	60
Table 51 – Unshelve result codes .....	60
Table 52 – Unshelve Method AddressSpace definition .....	61
Table 53 – TimedShelve parameters .....	61
Table 54 – TimedShelve result codes .....	61
Table 55 – TimedShelve Method AddressSpace definition .....	62
Table 56 – OneShotShelve result codes .....	62
Table 57 – OneShotShelve Method AddressSpace definition .....	62
Table 58 – LimitAlarmType definition .....	63
Table 59 – ExclusiveLimitStateMachineType definition .....	65
Table 60 – ExclusiveLimitStateMachineType transitions .....	65
Table 61 – ExclusiveLimitAlarmType definition .....	66
Table 62 – NonExclusiveLimitAlarmType definition .....	68
Table 63 – NonExclusiveLevelAlarmType definition .....	68
Table 64 – ExclusiveLevelAlarmType definition .....	69
Table 65 – NonExclusiveDeviationAlarmType definition .....	69
Table 66 – ExclusiveDeviationAlarmType definition .....	70
Table 67 – NonExclusiveRateOfChangeAlarmType definition .....	71
Table 68 – ExclusiveRateOfChangeAlarmType definition .....	71
Table 69 – DiscreteAlarmType definition .....	72
Table 70 – OffNormalAlarmType Definition .....	72
Table 71 – SystemOffNormalAlarmType definition .....	73
Table 72 – TripAlarmType definition .....	73
Table 73 – InstrumentDiagnosticAlarmType definition .....	74
Table 74 – SystemDiagnosticAlarmType definition .....	74
Table 75 – CertificateExpirationAlarmType definition .....	74

Table 76 – DiscrepancyAlarmType definition.....	75
Table 77 – BaseConditionClassType definition .....	76
Table 78 – ProcessConditionClassType definition .....	76
Table 79 – MaintenanceConditionClassType definition .....	77
Table 80 – SystemConditionClassType definition .....	77
Table 81 – SafetyConditionClassType definition .....	77
Table 82 – HighlyManagedAlarmConditionClassType definition .....	78
Table 83 – TrainingConditionClassType definition .....	78
Table 84 – StatisticalConditionClassType definition .....	78
Table 85 – TestingConditionSubClassType definition.....	79
Table 86 – AuditConditionEventType definition .....	80
Table 87 – AuditConditionEnableEventType definition .....	80
Table 88 – AuditConditionCommentEventType definition .....	81
Table 89 – AuditConditionRespondEventType definition .....	81
Table 90 – AuditConditionAcknowledgeEventType definition.....	81
Table 91 – AuditConditionConfirmEventType definition .....	82
Table 92 – AuditConditionShelvingEventType definition .....	82
Table 93 – AuditConditionSuppressionEventType definition .....	82
Table 94 – AuditConditionSilenceEventType definition .....	83
Table 95 – AuditConditionResetEventType definition .....	83
Table 96 – AuditConditionOutOfServiceEventType definition .....	83
Table 97 – RefreshStartEventType definition <small>IEC 62541-9:2020 <a href="https://standards.iec.ch/catalog/standards/sist/89737e60-7c58-4dda-a7eb-15d20968/iec-62541-9-2020">https://standards.iec.ch/catalog/standards/sist/89737e60-7c58-4dda-a7eb-15d20968/iec-62541-9-2020</a></small> .....	84
Table 98 – RefreshEndEventType definition <small>IEC 62541-9:2020 <a href="https://standards.iec.ch/catalog/standards/sist/89737e60-7c58-4dda-a7eb-15d20968/iec-62541-9-2020">https://standards.iec.ch/catalog/standards/sist/89737e60-7c58-4dda-a7eb-15d20968/iec-62541-9-2020</a></small> .....	84
Table 99 – RefreshRequiredEventType definition .....	85
Table 100 – HasCondition <i>ReferenceType</i> .....	85
Table 101 – Alarm & Condition result codes.....	86
Table 102 – HasEffectDisable <i>ReferenceType</i> .....	91
Table 103 – HasEffectEnable <i>ReferenceType</i> .....	91
Table 104 – HasEffectSuppress <i>ReferenceType</i> .....	92
Table 105 – HasEffectUnsuppress <i>ReferenceType</i> .....	92
Table 106 – AlarmMetricsType Definition .....	93
Table 107 – AlarmRateVariableType definition.....	94
Table 108 – Suppress result codes .....	94
Table 109 – Reset Method AddressSpace definition .....	95
Table A.1 – Recommended state names for LocaleId "en" .....	96
Table A.2 – Recommended display names for LocaleId "en" .....	96
Table A.3 – Recommended state names for LocaleId "de" .....	97
Table A.4 – Recommended display names for LocaleId "de" .....	97
Table A.5 – Recommended state names for LocaleId "fr" .....	98
Table A.6 – Recommended display names for LocaleId "fr" .....	98
Table A.7 – Recommended dialog response options .....	98
Table B.1 – Example of a Condition that only keeps the latest state.....	99
Table B.2 – Example of a <i>Condition</i> that maintains previous states via branches .....	101

Table C.1 – EEMUA Terms .....	104
Table D.1 – Mapping from standard Event categories to OPC UA Event types .....	106
Table D.2 – Mapping from ONEVENTSTRUCT fields to UA BaseEventType Variables.....	108
Table D.3 – Mapping from ONEVENTSTRUCT fields to UA AuditEventType Variables.....	108
Table D.4 – Mapping from ONEVENTSTRUCT fields to UA AlarmType Variables .....	109
Table D.5 – Event category attribute mapping table .....	113
Table E.1 – IEC 62682 Mapping.....	119
Table F.1 – SystemStateStateMachineType definition.....	129
Table F.2 – SystemStateStateMachineType transitions .....	130

## iTeh STANDARD PREVIEW (standards.iteh.ai)

[IEC 62541-9:2020](#)

<https://standards.iteh.ai/catalog/standards/sist/89737e60-7c58-4dda-a7eb-f75d92c97068/iec-62541-9-2020>

# INTERNATIONAL ELECTROTECHNICAL COMMISSION

## OPC UNIFIED ARCHITECTURE –

### Part 9: Alarms and Conditions

#### FOREWORD

- 1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
- 2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
- 3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
- 4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
- 5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
- 6) All users should ensure that they have the latest edition of this publication.
- 7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
- 8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
- 9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International standard IEC 62541-9 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- a) added optional engineering units to the definition of RateOfChange alarms;
- b) to fulfill the IEC 62682 model, the following elements have been added:
  - AlarmConditionType States: Suppression, Silence, OutOfService, Latched;
  - AlarmConditionType Properties: OnDelay, OffDelay, FirstInGroup, ReAlarmTime;

- New alarm types: DiscrepancyAlarm, DeviationAlarm, InstrumentDiagnosticAlarm, SystemDiagnosticAlarm.
- c) added Annex that specifies how the concepts of this OPC UA part maps to IEC 62682 and ISA 18.2;
- d) added new ConditionClasses: Safety, HighlyManaged, Statistical, Testing, Training;
- e) added CertificateExpiration AlarmType;
- f) added Alarm Metrics model.

The text of this International Standard is based on the following documents:

FDIS	Report on voting
65E/709/FDIS	65E/727/RVD

Full information on the voting for the approval of this International Standard can be found in the report on voting indicated in the above table.

This document has been drafted in accordance with the ISO/IEC Directives, Part 2.

Throughout this document and the other parts of the IEC 62541 series, certain document conventions are used:

*Italics* are used to denote a defined term or definition that appears in the "Terms and definition" clause in one of the parts of the IEC 62541 series.

## THE STANDARD PREVIEW (standards.iteh.ai)

*Italics* are also used to denote the name of a service input or output parameter or the name of a structure or element of a structure that are usually defined in tables.

[IEC 62541-9:2020](https://standards.iteh.ai/catalog/standards/sist/89737e60-7c58-4dda-a7eb-15d92c97008/iec-62541-9-2020)

The *italicized terms and names* are, with a few exceptions, written in camel-case (the practice of writing compound words or phrases in which the elements are joined without spaces, with each element's initial letter capitalized within the compound). For example the defined term is *AddressSpace* instead of *Address Space*. This makes it easier to understand that there is a single definition for *AddressSpace*, not separate definitions for *Address* and *Space*.

A list of all parts of the IEC 62541 series, published under the general title *OPC Unified Architecture*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under "<http://webstore.iec.ch>" in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

**IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.**

## OPC UNIFIED ARCHITECTURE –

### Part 9: Alarms and Conditions

## 1 Scope

This part of IEC 62541 specifies the representation of *Alarms* and *Conditions* in the OPC Unified Architecture. Included is the *Information Model* representation of *Alarms* and *Conditions* in the OPC UA address space. Other aspects of alarm systems such as alarm philosophy, life cycle, alarm response times, alarm types and many other details are captured in documents such as IEC 62682 and ISA 18.2. The *Alarms and Conditions Information Model* in this specification is designed in accordance with IEC 62682 and ISA 18.2.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

### iTeh STANDARD PREVIEW IEC TR 62541-1, OPC unified architecture – Part 1: Overview and concepts (standards.iteh.ai)

IEC 62541-3, OPC unified architecture – Part 3: Address Space Model

[IEC 62541-9:2020](#)

IEC 62541-4, OPC unified architecture – Part 4: Services  
[https://standards.iteh.ai/docstore/7e60-7c58-4dda-a7eb-f75d92c97068/iec-62541-9-2020](#)

IEC 62541-5, OPC unified architecture – Part 5: Information Model

IEC 62541-6, OPC unified architecture – Part 6: Mappings

IEC 62541-7, OPC unified architecture – Part 7: Profiles

IEC 62541-8, OPC unified architecture – Part 8: Data Access

IEC 62541-11, OPC unified architecture – Part 11: Historical Access

IEC 62682: Management of alarms systems for the process industries

EEMUA: 2nd Edition EEMUA 191 – Alarm System – A guide to design, management and procurement (Appendices 6, 7, 8, 9), available at  
<https://www.eemua.org/Products/Publications/Print/EEMUA-Publication-191.aspx>

## 3 Terms, definitions, abbreviated terms and data types used

### 3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TR 62541-1, IEC 62541-3, IEC 62541-4, and IEC 62541-5 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

**3.1.1****Acknowledge**

*Operator* action that indicates recognition of an *Alarm*

Note 1 to entry: This definition is copied from EEMUA. The term "Accept" is another common term used to describe *Acknowledge*. They can be used interchangeably. This document uses *Acknowledge*.

**3.1.2****Active**

*state for an Alarm* that indicates that the situation the *Alarm* is representing currently exists

Note 1 to entry: Other common terms defined by EEMUA are "Standing" for an *Active Alarm* and "Cleared" when the *Condition* has returned to normal and is no longer *Active*.

**3.1.3****AdaptiveAlarm**

*Alarm* for which the set point or limits are changed by an algorithm

Note 1 to entry: *AdaptiveAlarms* are alarms that are adjusted automatically by algorithms. These algorithms can detect conditions in a plant and change setpoints or limits to keep alarms from occurring. These changes occur, in many cases, without *Operator* interactions.

**3.1.4****AlarmFlood****iTeh STANDARD PREVIEW**

condition during which the alarm rate is greater than the *Operator* can effectively manage  
[\(standards.iteh.ai\)](https://standards.iteh.ai)

Note 1 to entry: OPC UA does not define the conditions that would be considered alarm flooding, these conditions are defined in other specifications such as IEC 62682 or ISA 18.20

<https://standards.iteh.ai/catalog/standards/sist/89737e60-7c58-4dda-a7eb-f75d92c97068/iec-62541-9-2020>

**3.1.5****AlarmSuppressionGroup**

group of *Alarms* that is used to suppress other *Alarms*

Note 1 to entry: An *AlarmSuppressionGroup* is an instance of an *AlarmGroupType* that is used to suppress other *Alarms*. If any *Alarm* in the group is active, then the *AlarmSuppressionGroup* is active. If all *Alarms* in the *AlarmSuppressionGroup* are inactive then the *AlarmSuppressionGroup* is inactive

Note 2 to entry: The *Alarm* to be affected references *AlarmSuppressionGroups* with a *HasAlarmSuppressionGroup ReferenceType*.

**3.1.6****ConditionClass**

*Condition* grouping that indicates in which domain or for what purpose a certain *Condition* is used

Note 1 to entry: Some top-level *ConditionClasses* are defined in this specification. Vendors or organisations can derive more concrete classes or define different top-level classes.

**3.1.7****ConditionBranch**

specific state of a *Condition*

Note 1 to entry: The Server can maintain *ConditionBranches* for the current state as well as for previous states.

**3.1.8****ConditionSource**

element which a specific *Condition* is based upon or related to

Note 1 to entry: Typically, this will be a *Variable* representing a process tag (e.g. FIC101) or an *Object* representing a device or subsystem.